ANL/NT/CP-106066

"ANL-W RH-TRU: THE REMOTE TREATMENT FACILITY"

By

W. R. Russ, D. S. Duncan, R. P. Grant

Nuclear Technology Division
Argonne National Laboratory-West
P. O. Box 2528
Idaho Falls, ID 83403-2528

To be Presented
at

Environmental Management Nondestructive
Assay Characterization Conference

Denver, Colorado
December 11-13, 2001

*Work supported by the U.S. Department of Energy, Office of Nuclear Energy, Science and Technology, under Contract W-31-109-ENG-38.

ANL-W RH-TRU: THE REMOTE TREATMENT FACILITY

W. R. Russ, D. S. Duncan, R. P. Grant
Argonne National Laboratory – West
Idaho Falls, Idaho 83403-2528
russ@anl.gov

ABSTRACT

Argonne National Laboratory – West has an inventory of RH-TRU waste that consists primarily of debris from EBR-II and hot cell operations, stored in liners at the Radioactive Scrap and Waste Facility (RSWF) and Radioactive Sodium Storage Facility (RSSF). About 25 cubic meters of the approximately 320 cubic meters of stored remote handled waste requiring treatment has been designated as transuranic, based on documentation. This documentation providing information about the waste, going back to 1965, varies in quality depending on the regulatory requirements at the time of storage. Much of the waste requires segregation, treatment and repackaging. One driver behind the need for treatment of the waste prior to shipping is the presence of metallic sodium, a prohibited item for storage at the Waste Isolation Pilot Plant (WIPP). Various legal and permitting drivers require that the stored waste be removed within a given time period. In order to meet these requirements, several options are being explored. One of these options is the construction of a new, on-site facility called the Remote Treatment Facility. This annex to the existing Hot Fuel Examination Facility would contain an air atmosphere hot cell with stations to enable inspection, sorting, treatment, assaying and repackaging for shipment.

1. INTRODUCTION

There are two primary legal mandates that require the ability to process and treat Remote Handled (RH) waste at Argonne National Laboratory – West (ANL-W). One of these is the Idaho National Engineering and Environmental Laboratory (INEEL) Site Treatment Plan (STP) Consent Order [1] that requires treatment capability for RH wastes regulated under the Resource Conservation and Recovery Act (RCRA) for wastes stored more than one year. The other mandate stems from the existing RCRA Part B hazardous and mixed waste storage permit [2] for the Radioactive Scrap and Waste Facility (RSWF) and Radioactive Sodium Storage Facility (RSSF). The permit requires that the Department of Energy (DOE) provide treatment capability for mixed wastes stored at RSWF and RSSF. The permit expires in 2004 and prior to renewal a means of processing this highly radioactive RH waste must be indicated to meet the permitting requirements and allow the continuance of programmatic activities at ANL-W. A variety of options are being considered to allow treatment and shipment of ANL-W RH waste. These options include using other INEEL facilities, using a mobile processing unit, or using other DOE sites (Hanford's T-Plant Complex and Waste Receiving and Processing facilities or ORNL's Waste Processing Facility). However, the preferred option with regards to schedule and cost is the construction of a Remote Treatment Facility (RTF) as an annex to ANL-W's Hot Fuel Examination Facility (HFEF) [3]. The concept of a facility like RTF has been considered for over 20 years without going beyond the feasibility stage, but now requirements necessitate the realization of a means to process ANL-W RH waste.

2. INVENTORY

There are approximately 320 m^3 of RH waste in temporary storage at the RSWF and RSSF at ANL-W that require treatment. The categories of this RH waste include low level waste (LLW), mixed low level waste (MLLW), transuranic waste (TRU), mixed transuranic waste (MTRU), and spent nuclear fuel (SNF). Radioactive components include uranium, plutonium and transuranics, while hazardous components consist primarily of reactive metallic sodium and some toxic metals such as lead and cadmium. SNF will be segregated and then processed at the ANL-W Fuel Conditioning Facility.

2.1 Radioactive Scrap and Waste Facility

RSWF consists of 1350 in-ground silo type storage liners located on 4 fenced acres about 0.5 miles northeast of the main ANL-W site. Storage of RCRA and radioactive waste began at RSWF in 1965. Prior to 1978, waste was placed in a single waste can, dropped into the liner and covered with gravel. After 1978, waste was placed into an inner can, a second container and then lowered into a liner with appropriate shielding. Waste generated after 1992 (RCRA) is considered well characterized. Figure 1 shows RSWF and illustrates a typical double containment storage liner (Figure 1). Table 1 indicates the inventory at RSWF for the various categories. It is estimated that the total RH-TRU inventory will be approximately 10-30 m^3 after processing.

Table 1 – RSWF Inventory by Category (m^3)

LLW	MLLW	TRU	MTRU	SNF
127.3	84.4	11.9	42.9	29.5

2.2 Radioactive Sodium Storage Facility

RSSF provides storage primarily for used HEPA filters and wastes associated with the Experimental Breeder Reactor (EBR) II Primary Sodium System. Examples include cold traps and nuclide traps, containing large curie contents inside heavily shielded vessels. While the RSSF stores a relatively small volume of waste, the 46 oversized and non-standard containers and shielding require special handling and treatment. Table 2 indicates the inventory at RSSF for the various categories.

Table 2 – RSSF Inventory by Category (m^3)

MLLW	MTRU
14.3	6.1

3. Remote Treatment Facility

The RTF is proposed to accept, characterize, segregate, treat and repackage the RH waste streams at RSWF and RSSF. As an annex to HFEF, the RTF would be able to share and interface with some HFEF systems, reducing capital and operational costs. The RTF is a 6.7×12.8×7.6 m high air atmosphere hot cell with 13 work stations, a hot repair area, waste cask handling capabilities and direct linkage with HFEF via the cask tunnel. Figure 2 shows a diagram of a cross section of a RTF conceptual design

(Figure 2). In-cell equipment will include a liner disassembler, waste sorter, sodium removal system, induction furnace, repackaging station, and a HEPA filter preparation station. The liner disassembler will sample RSWF liners, cut up the outer liner, remove shielding and remove the inner container. The waste sorter is a remote sorting system that consists of a waste sorting module, a TRU-waste repackaging module, process waste reduction and packaging module, and a systems integration and control module. The sorter will remove the inner lids and visually identify and segregate each item automatically. The sodium removal system will remove sodium contamination from waste using a method such as that employed by a Melt-Drain-Evaporate (MEDE) system. The induction furnace will be used for volume reduction of metallic waste. The repackaging station will be used to containerize sorted, treated waste into appropriate canisters. Finally, the HEPA filter preparation station will treat HEPA filters by separating frame and filter media for separate volume reductions. In addition, a nondestructive assay (NDA) cell, below the hot cell, will provide a shielded cavity for characterization of the waste. Figure 3 shows a material process flow diagram illustrating how wastes will be processed through RTF (Figure 3).

Figures 4 and 5 show how the wastes will likely be characterized based on assay techniques and waste acceptance criteria, respectively (Figures 4, 5). Assay techniques include dose rate measurements, gamma-ray spectrometry, passive and active neutron measurements and destructive assay via the ANL-W Analytical Laboratory. The flexibility of the processing allows for either a final shipping assay of a full, packaged container or a piecemeal assay, item by item, for the more difficult wastes to characterize. The ability to utilize acceptable knowledge of the waste will greatly facilitate planning and processing. However, the quality of such documentary information varies widely, depending on the regulatory requirements at the time of storage.

The schedule for the construction and operation of the RTF is driven by regulatory constraints. Waste processing operations need to begin in 2009, following construction from 2004-2008. Approximately six years of operations would then be required to complete the waste processing in late 2015. The cost estimates include about \$30M for construction, about \$14.5M for equipment, and about \$32M for seven years of operations.

4. CONCLUSIONS

DOE Order 413.3, directing the program and project management for the acquisition of capital assets, indicates the process for the acquisition of the RTF through a series of Critical Decision (CD) stages. CD-0, the Mission Need Statement, was approved in October 2000. The final waste acceptance criteria for all of the various waste streams must be known, particularly for the waste characterization requirements of the RTF. Documentation of waste content and configuration should be used to perform dynamic modeling of characterization and treatment processing to facilitate planning and equipment acquisition. Other considerations in considering the value of the RTF are possible missions beyond that of ANL-W RH waste processing. Alternative and post-waste missions include INEEL RH wastes, nuclear energy, national security, and environmental technology research and development.

REFERENCES

[1] U.S. Department of Energy, Idaho Operations Office, 1995, Idaho National Engineering and Environmental Laboratory Site Treatment Plan

[2] "ANL-W RCRA Part B Permit Application", Argonne National Laboratory – West Document No. W0001-0920-ES-04

[3] "Remote Treatment Facility – Feasibility Report", Rev 02, 09/28/01, Argonne National Laboratory – West Document No. W0810-0001-ES

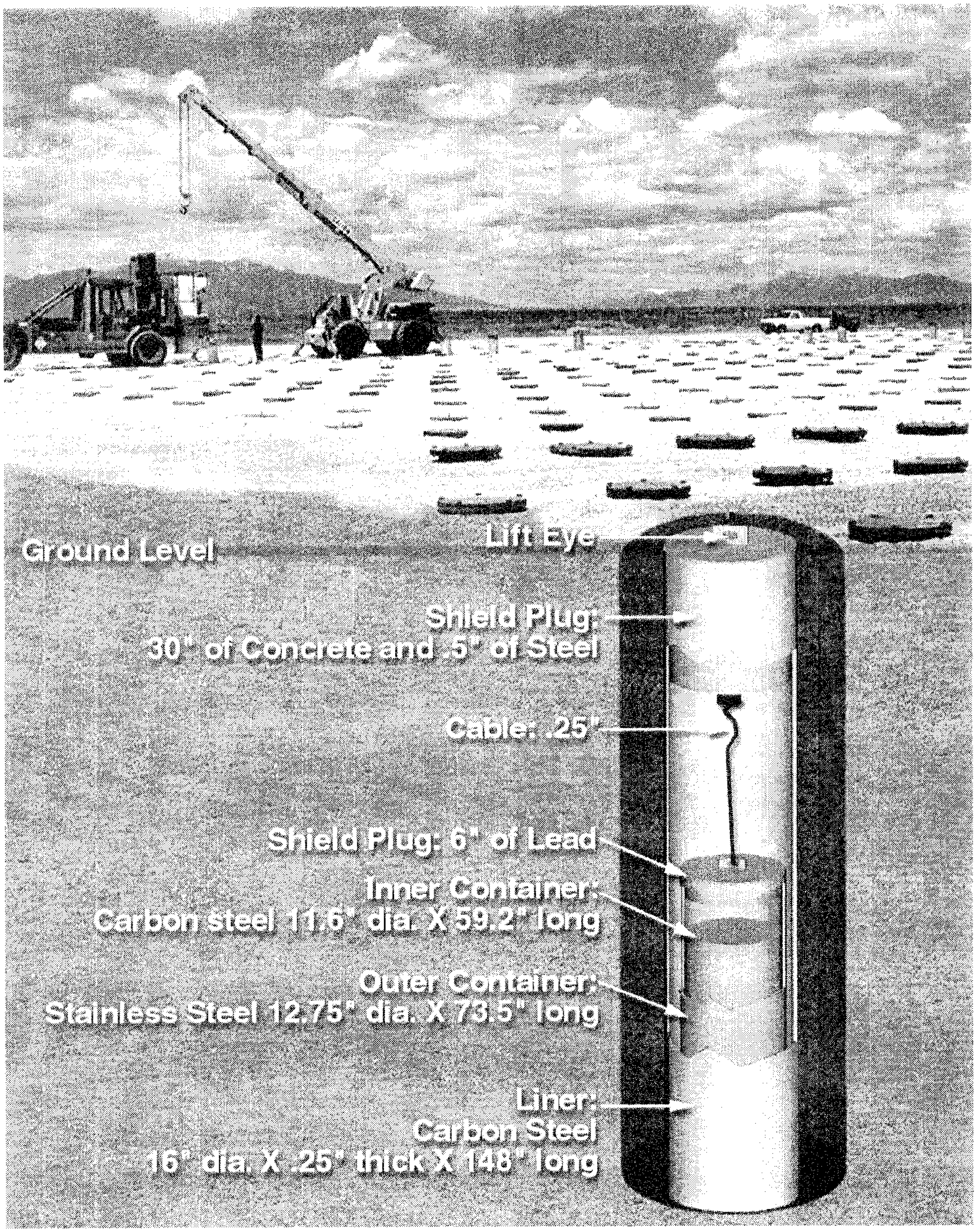

Figure 1 – The Radioactive Scrap and Waste Facility with a typical double containment storage liner.

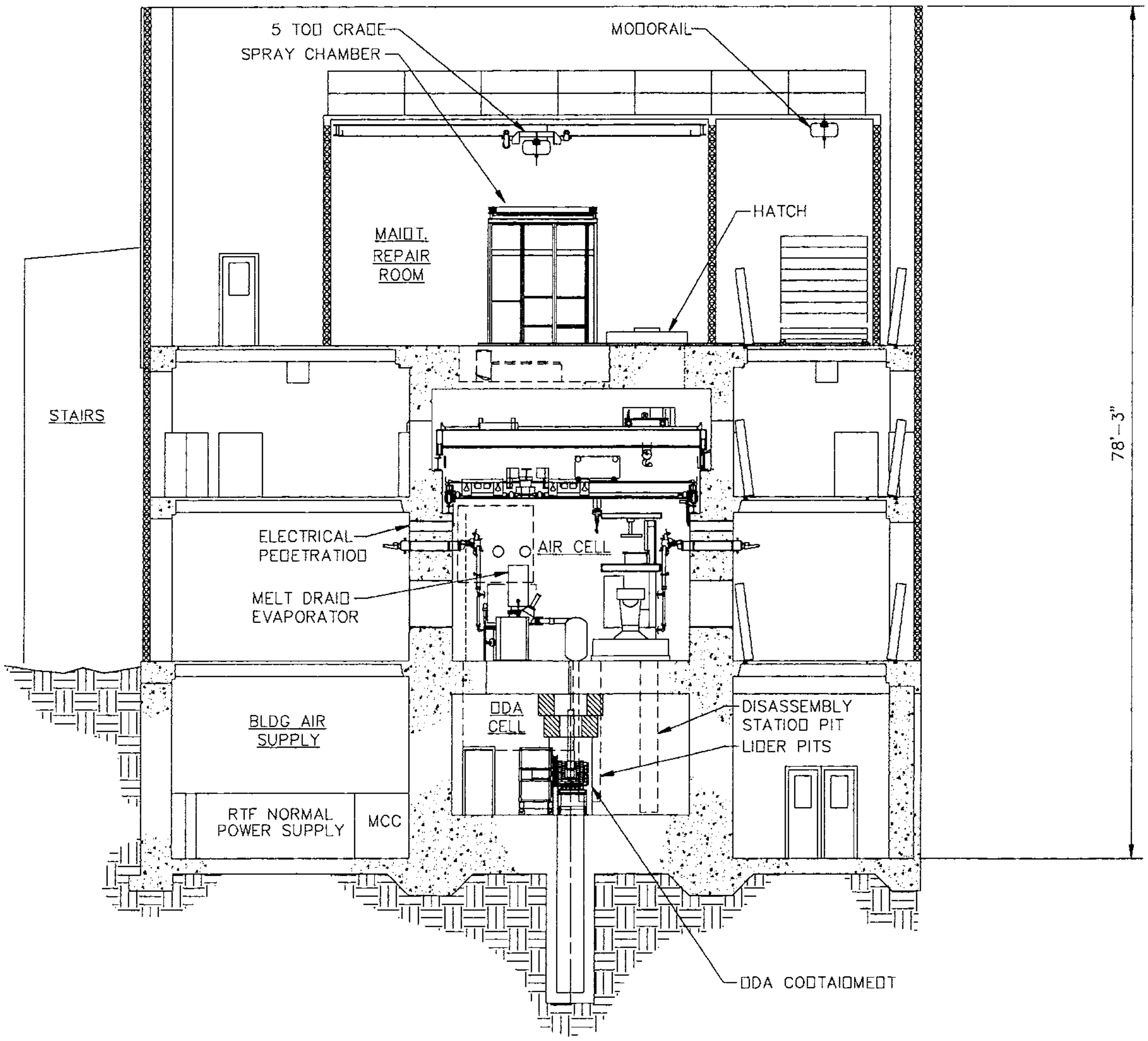

Figure 2 – Cross-sectional diagram of possible ANL-W Remote Treatment Facility.

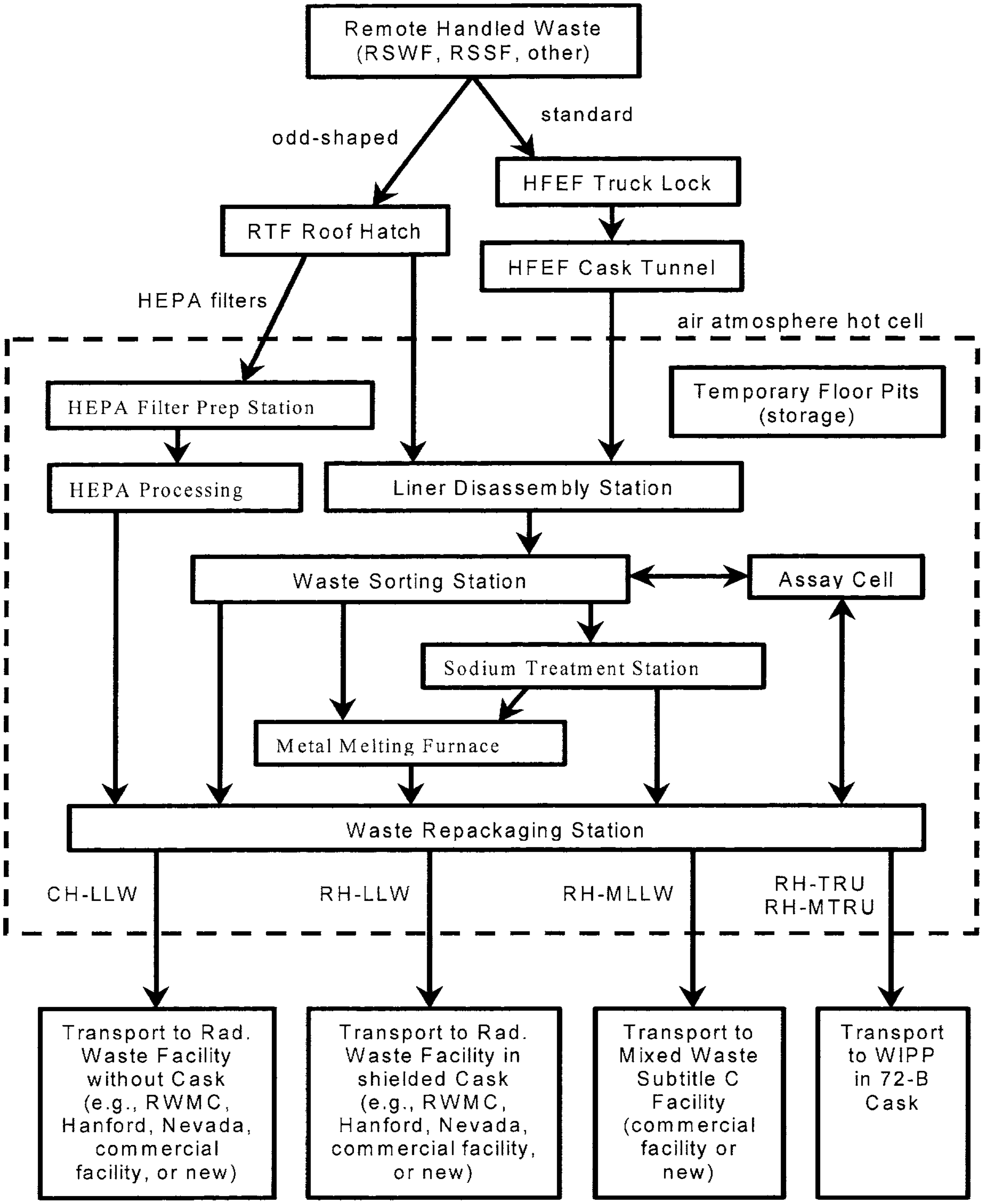

Figure 3 – Possible waste material processing diagram for the ANL-W Remote Treatment Facility.

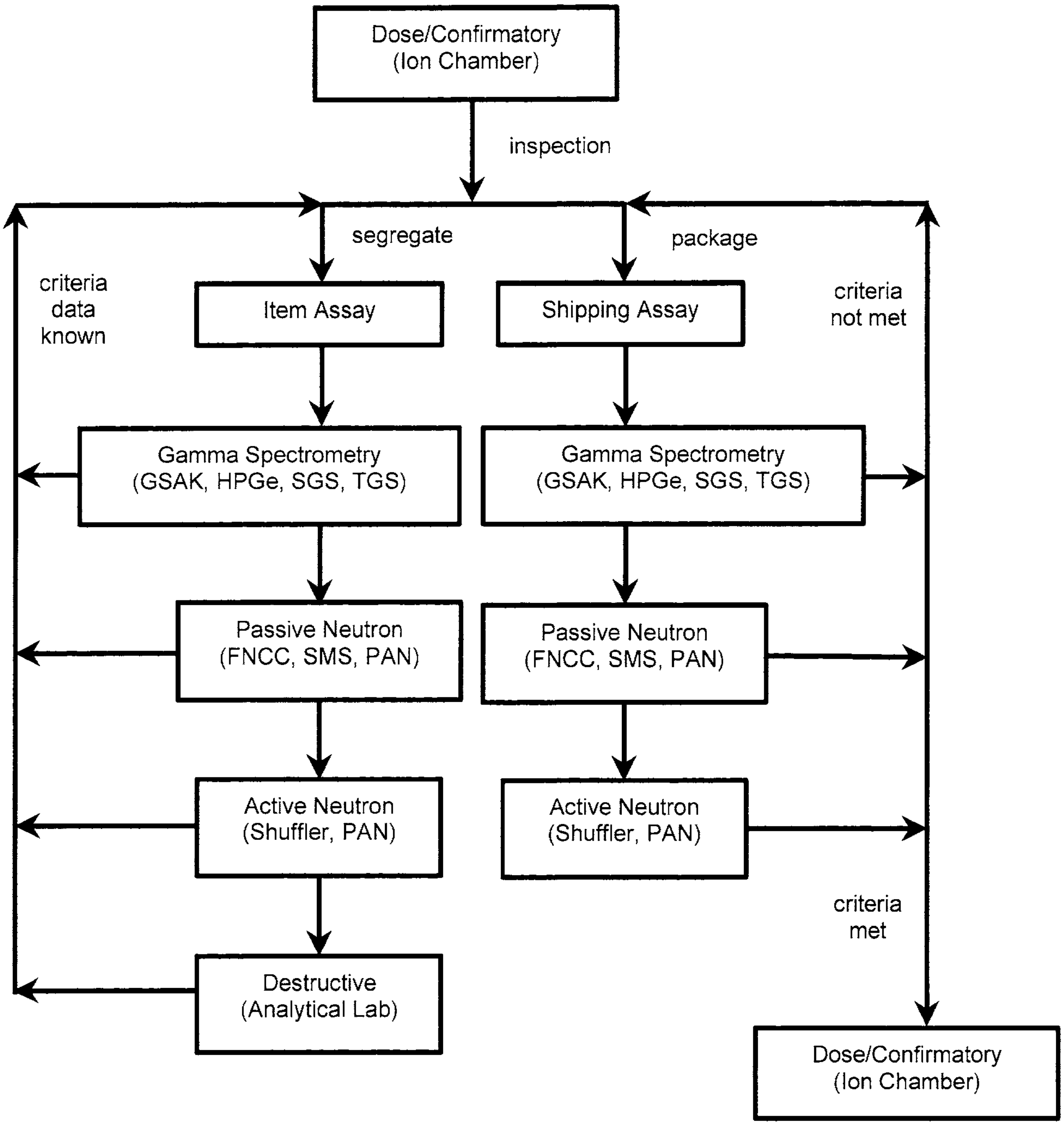

Figure 4 – Possible waste assay processing for the ANL-W Remote Treatment Facility.

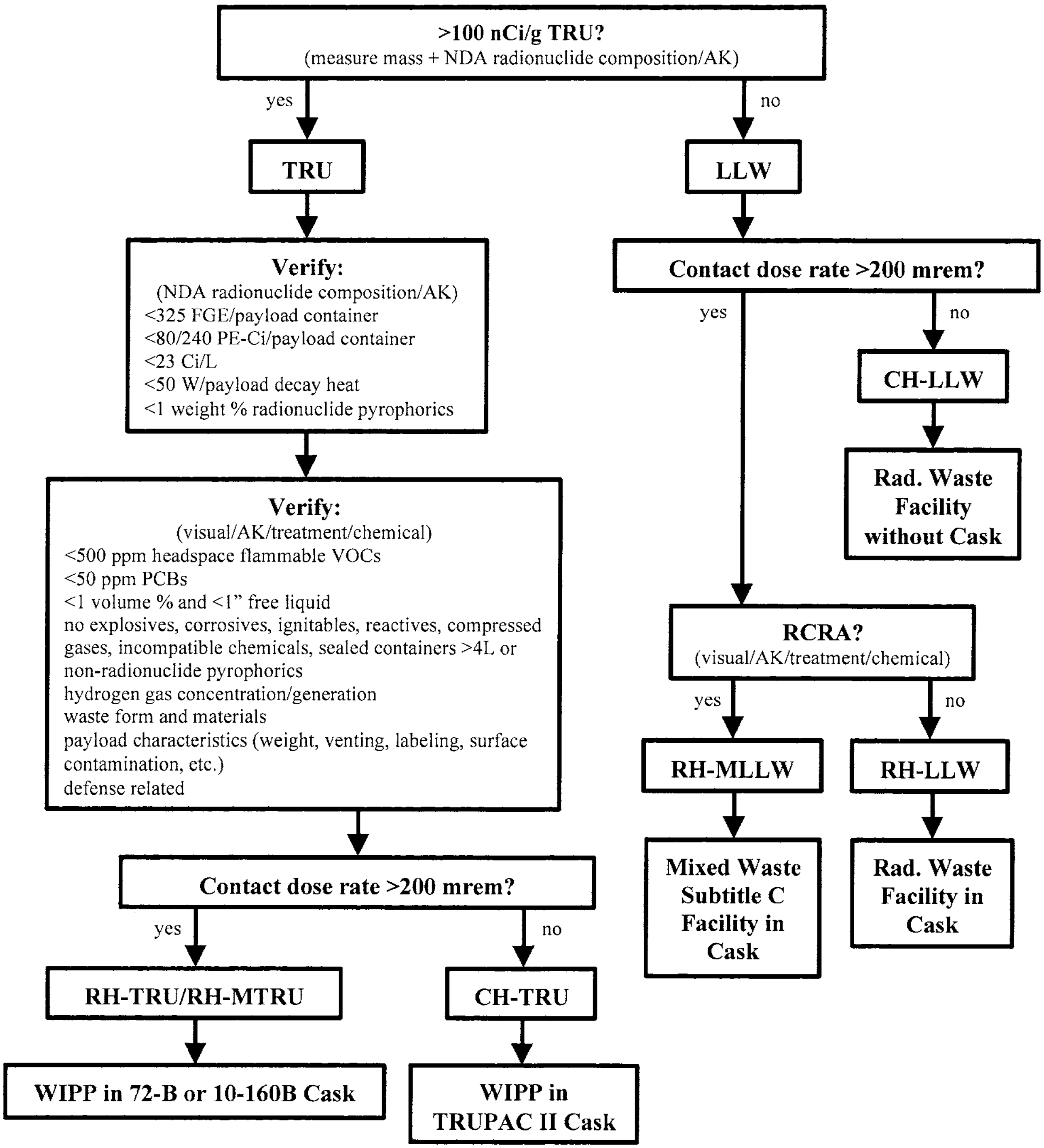

Figure 5 – Possible verification and segregation processing for the ANL-W Remote Treatment Facility.